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Master Thesis Data Science and Marketing Analytics

A Multiple Correspondence Analysis of Live-streaming Motivation and Affordance Preference by Twitch Live-streamers

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Abstract

This thesis tries to find an association between the motivations of Twitch live-streamers and the affordances inherent in live-streaming products. Given the popularity of Twitch and live-streaming, there exist opportunities for the industry to create products that can appeal to live-streamer's motivations. Product designers and software developers have ample opportunities in this space. By understanding the latent connections between how products are being used (affordances) and what motivations a live-streamer has for live-streaming, a product department could harness this information during the development stages of new products to address these preferences. Through a self-reporting survey of 141 Twitch live-streamers this thesis analyzed the responses of current live-streamers to understand why they live-stream and what products (affordance elements) they are currently using. A previous study of the types of affordances that current live-streaming products (affordance elements) possess was extremely helpful in linking the affordances to the affordance elements in the survey.

To help understand what associations exist between the affordances and live-streamer motivations a multiple correspondence analysis was leveraged to interpret the data and define several groups that described different associations among the separate groups. The research was able to identify six areas: casual live-streamer, casual fun, effective executors, alignment opportunity, therapy facilitators and disinterested. Each having a different combination of motivational preference and affordance influence. Some groups showed a propensity for different affordances given motivations and could provide marketers and product developers with opportunities for success in the growing live-streaming market.

Keywords: *Affordance Theory, Twitch, Live-streaming, Multiple Correspondence Analysis*

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2 Introduction

In today's digital world many of the traditional forms of media are being surpassed in popularity by new media delivery services. Additionally, there are increasing elements of social engagement that go beyond television and movies. Sites like YouTube and Twitch provide both a media service along with a social interaction aspect. Specifically, Twitch offers a unique environment for viewer and creator interactions.

Twitch is currently the largest live-streaming video platform in the U.S. with 2.2 to 3.2 million monthly broadcasters and 15 million unique daily users (Influencer Marketing, 2019; Twitch, 2016). Twitch looks more like a social community than most entertainment providers due to the level of user participation that a content creator, or *live-streamer*, can bring to their broadcast. Twitch provides multiple types of tools that live-streamers can use to engage with the audience. These features create an interesting dynamic by allowing viewers to contribute monetarily to the live-streamer during the live broadcast, via donations, cheer bits and subscriptions. Additionally, there are a few third-party software suppliers that Twitch suggests using when stepping into the live-streaming environment (Twitch, 2019a). These third-party software companies have integrated their platforms into the Twitch live-streaming service and offer many engaging features for the live-streamer to leverage. Some examples include the ability to set-up automatic polling during your live-stream; mini-games that allow viewers to gamble "social credits" that were earned through the live-streamer's chat box and chat bots that can promote desired messaging for the live-streamer. As Twitch has grown, so have these types of companies along with their market potential. This increase creates opportunities for these companies to expand or better target desired live-streamers. For this reason, it is important to understand the current live-streamer market and research has established some solid foundations.

A recent paper by Sjöblom, Törhönen, Hamari, and Macey (2019) explored what specific live-streaming affordances are leveraged by the top 250 live-streamers. They observed the preferences for types of affordance elements during live-streaming and connected the usage to affordance theory. The term *affordance* was derived from affordance theory, which was originally named by Gibson (1979) and used to describe the interactions that inhabitants have with elements

within their environment. After its introduction, the theory has been applied to many areas including human and computer interaction. A simple example of an affordance would be 'pressing'; which an affordance element like a button on a computer keyboard is designed to entice this type of affordance into action. A more complicated example that relates to live-streaming on Twitch can be the donation button. Like the tip line on a restaurant receipt, the donation button is an environmental element that is used to trigger the action of a reward for the service behavior that was provided. This affordance element can be viewed as an enticement of the act of tipping based on the live-streamer's service performance from the viewer's perspective. There are many more types of affordance elements during a live-stream that look to induce a variety of affordances. Note that affordance elements are typically referred to as the actual objects in the environment. If we are using the non-technical verbiage the microphone would be a live-streaming object that is covered by the technical term affordance element. Since this is a research paper the term, affordance element, will be used to describe the features present during live-streaming. Many other affordance elements also exist, and recent research has already identified several affordance elements in the live-streaming space and a more in-depth discussion will follow in this paper about what types of affordances are derived from specific affordance elements.

Looking at the general affordance theory, it should be noted that an affordance exists for an affordance element regardless of whether the user perceives the affordance or not (Gaver, 1991). This is a crucial statement and the focal point in the design of affordance elements by individuals and companies. When the designer of the affordance element creates a new object or software, their intention is that certain affordances will be engaged for that affordance element. Like the microphone example, the designer may have only wanted the user to be able to deliver the sound of their voice through the live-stream. However, their perception of the affordances is only a limited view. Once that element is introduced to the public/environment it may be used in ways that were not considered previously. For instance, the microphone might be affording generative role-taking for the live-streamer because the live-streamer is using it to show the audience that they are the one in-charge of the live-stream channel. That is why the research by Sjöblom et al. (2019) was important for understanding how the current designed affordance elements in a live-stream are delivering on previously unconsidered affordances. The observations will allow this research to show how strong the preference is for certain affordances based on the types of

affordance elements used by a live-streamer. This preference for affordances and the motivations of the live-streamer could help designers and marketers in the development of their products.

Beyond affordance theory several papers have explored the motivations behind viewing and live-streaming on Twitch. For instance, research into the reasons why live-streamers continue to stream on Twitch noted several intrinsic and extrinsic motivations for broadcasting on Twitch (Zhao, Chen, Cheng, & Wang, 2018). Their paper looked at the expectation's live-streamers had for live-streaming on Twitch specifically. The performance expectations for the website were both driven by intrinsic and extrinsic motivations and the performance expectancies had significant impact on the perceived attractiveness of the website (Zhao et al., 2018). Basically, a live-streamer chooses to stream on Twitch because the website has the performance capabilities to deliver a seamless stream without buffering or other glitches. Thus, increasing the user's perception of an attractive website. This important aspect can build loyalty to the website which helps it become an industry leader in the area of live-streaming.

Additionally, two separate papers into viewer motivations for watching Twitch reflected entertainment and social interaction as significant factors for viewer motivations (Chen & Lin, 2018; Hilvert-Bruce, Neill, Sjöblom, & Hamari, 2018). The work done in this research helps control for viewer motivations on the Twitch live-streaming platform. Preventing functionality differences that could affect live-streamers' and viewers' motivations and preferences. The layered research provided insight into the Twitch performance environment, user eco-system, and platform participations that other websites currently do not have available. For that reason, this research has chosen to focus on Twitch live-streamers, since performance motivations can be controlled by limiting the research scope to the Twitch website.

Given past research on live-streaming motivations, the expansion of affordance theory into live-streaming and the growth of Twitch, the next logical step in the process is to link the motivations of live-streamers and the use of the affordance elements to determine what relationships can be uncovered. This is crucial to determining if there is a relationship between motivations to live-stream and the selections of affordance elements in the live-stream. Third party developers are constantly designing new software that have different affordance elements which

may be used differently than the original expectation. That is where affordance theory shines, on the understanding of which affordances are derived from the affordance elements. If there is a relationship seen between motivations and the affordance elements chosen, marketers and designers could begin to tailor their business to the live-streamers that align with the company's products. Therefore, it is the goal of this research to answer the following research question:

- **What latent associations exist between the live-streamer's motivations for live-streaming and the preference for affordances, which are inherent in the design and usage of the affordance elements that are chosen for display in the video and profile sections of the live-stream?**

The remaining portion of this paper has the following structure. Section 3 will explore the background of the live-stream environment. Section 4 takes a deeper look at the origins of affordance theory, past research and the links to Twitch's tool usages for live-streaming. Section 5 looks at the link between affordance theory, the elements used in Twitch and how preference for a certain affordance can influence element selection. Section 6 will discuss the measurements used for data collection in the survey. Section 7 will be the methodology of the survey process, data collection procedures and model building. Section 8 will present the results of the multiple correspondence analysis and dimension interpretation. Section 9 will provide the conclusion and discussion from the research.

3 Twitch and Live-streaming

Video consumption is now available through many different media outlets. As the internet has become more intertwined in the daily lives of today's consumers, platforms like YouTube and Twitch have become major players in the digital video arena for live-streaming; with Twitch's service being "more than twice that of YouTube's live-streaming branch" (Peter Rubenstein, 2018). This dominance of the live-streaming space has forced Twitch to expand beyond the video game live-streaming platform to broadcasters doing talk shows, podcasts, performing ASMR and just chatting with their viewers in a pseudo two-way audio-visual conversation with a chat box. This diversification has allowed many more people to become a member of the live-streaming community (James Mattone, 2019).

With the changes of the live-stream community on Twitch it is important to understand how live-streaming is defined. Live-streaming, for the context of this research, is best described by Sjöblom & Hamari as "conveying media content in a way that it is simultaneously consumed by the receiver" (2017). This process of media delivery is more commonly referred to as *live-streaming* and is solely internet based with content creators being decentralized amateur individuals (Sjöblom et al., 2019). Additionally, live-streaming includes a valuable social interaction affordance element that allows the viewers to communicate with the streamer in real-time, through a chat box. Twitch offers additional forms of interaction with special emotes, cheering bits, individual donations and the option to subscribe to designated streamers for a monthly fee between $4.99 to $24.99 (Twitch, 2019b).

As previously mentioned, the expansion of live-stream genre offerings means that Twitch live-streaming is moving beyond the traditional video-gaming live-stream of its past and creating new opportunities for live-streamers that do not share the affinity for video games of traditional creators. Live-streamers now have niche genres to live-stream to their audiences. This has the potential to create the many new types of live-streamers with different tool usage and motivations that have not previously been studied. Current literature has focused on the largest live-streamers, but this narrow view misses the long-tail opportunity that can exist for third-party software suppliers. Providing an understanding for the types of live-streaming elements that these smaller

live-streamers use and the motivations associated with their usage can help marketing campaigns target the right people for their products.

4 Affordance Theory

Affordance theory is a method to understand the tools and objects used in a specific environment (Sjöblom et al., 2019). The origination of the term *affordance* has been attributed to an article by Gibson (1979), which noted the possibilities an environment can provide to its inhabitants. This term was later adopted by McGrenere and Ho (2000), refined to a more modern meaning and defined as "the design aspect of an object which suggests how the object should be used." The term has found its way into the human-computer interaction (HCI) field of study which has changed the meaning further to establish the perception of the individual playing a significant role in being able to identify and interpret affordances (Norman, 1988; Sjöblom et al., 2019). As affordance research progressed, the term has evolved and been used to describe a list of invariant uses for elements in the environment independent of the needs of the users (Bucher & Helmond, 2018; Gibson, 1979). Meaning that regardless of the changes in the needs of the users, the elements have designated uses that will not change; remember the donation button example earlier in this paper. However, the term has been transformed by others to analyze the uses of elements in changing social environments (Bucher & Helmond, 2018; Norman, 1988; Sjöblom et al., 2019). This expansion led to applying the theory to modern communication technologies from the social perspective. Affordances research defined the social elements as, *social affordances*, meaning "the social structures that take shape in association to a given technical structure" (Postigo, 2016). The focus of that research pertained to individuals interactions with their environments in the social context of YouTube and how the creation of affordance elements by YouTube may have been developed under a set of assumptions that were being interpreted differently by the users of these affordance elements (Postigo, 2016). The current research paper looks to add a similar analysis that is specific to the Twitch platform by looking at Twitch live-streamers motivations and usages of the affordance elements that Twitch and third-party developers have created. This is made possible by additional research that already looked at social networking sites along with Twitch and established new social interactions.

With a new focus on the social interaction aspect, researchers pushed into social networking sites (SNS); identifying types of social affordances (Sjöblom et al., 2019). Six types of social affordances were noted by O'Riordan, Feller, and Nagle (2016); profile building, social

connectivity, social interactivity, content discovery, content sharing and content aggregation. These affordances were specific to SNS like Facebook. Furthermore, four other social affordances; *Meta-voicing,* the process of users adding knowledge to existing content; *triggered attending,* which was identified as users taking part of online activities or conversations after receiving some sort of notification; *network-informed associating*, when users participate in online activities due to the relational and content ties, such as chat forums; *generative role-taking*, is the process of users involving themselves in the management and maintenance of an online community (Majchrzak, Faraj, Kane, & Azad, 2013).

More recent usages of affordance theory expanded upon these social network studies, specifically Sjöblom et al. (2019) explored the affordances of Twitch live-streamers. Sjöblom et al. (2019) were able to identify several affordance elements that were being employed by top live-streamers and attribute them to the appropriate affordance from prior researchers. The research showed that the affordance elements of webcam overlays and microphones, created a two-way audiovisual communication environment which helped the live-streamer establish a social affordance. Sjöblom et al. (2019) noted that the two-way communication created a virtual stage that showcases the live-streamer. This allows the live-streamer to highlight their behaviors and knowledge, which can be crafted in specific ways to formulate a persona as an entertainer; to drive more social connectivity; or to emphasize social interactivity with the viewers (O'Riordan et al., 2016). This identification is a key research point for this paper's research question, as we are interested in determining if a link exists between a live-streamer's motivation and these affordances using certain affordance elements. Sjöblom et al. research seems to imply that live-streamers with strong motivations for being an entertainer, increasing the social connections or striving for social interactivity with viewers might want to use both webcam overlays and microphones during their live-streams.

Sjöblom et al. (2019) also identified a new category of affordances, *revenue affordances,* which is comprised of two subcategories: *social revenue* and *commercial revenue*. These types of affordances are prevalent for many of the live-streamers that were observed. The social revenue affordances were described as, "monetization through increased social visibility and competitive elements" (Sjöblom et al., 2019). Examples of these affordance elements are the donation pop-up

notification and top donor lists; which use social praise to drive more donations from viewers and can create a possible “donation war” (KittyPlays, 2016). Commercial revenue affordances were defined as, “monetization through traditional product placement or advertising” (Sjöblom et al., 2019). An example of this type of affordance element is the traditional advertisement of a product by the live-streamer during the live-stream, such as recommending or promoting a product while live-streaming (Ninja, 2019).

This research paper will be leveraging the prior work on social affordances for digital platforms and research on Twitch motivational studies to uncover any relationships between Twitch affordances and Twitch live-streamer broadcasting motivations.

5 Motivations and Affordance Preference

As discussed earlier there appear to be indications, given the past research, that the motivations of a live-streamer to broadcast themselves could have an association with their affordance preferences. A live-streamer with motivations to be an entertainer may choose to select affordance elements that align with a *microcelebrity* affordance (Senft, 2013). For instance, a live-streamer with motivations to be an entertainer may want to display themselves within their live-stream via a webcam overlay. As Senft (2013) pointed out in reference to research on camgirls, the visual blog became a self-branding moment as the camgirls looked to maintain an online persona that only displayed the brand they wished to release to their fans. The Twitch live-streamer can be facilitating a similar practice with their webcam overlay and could be compounding the self-branding image with the additions of a microphone that can add individualized commentary to their live-stream that enhances the self-brand. Examples of famous streamers that use a similar technique are Dr. DisRespect, Ninja, and TimTheTatman. This type of behavior is referred to as *profile-building* and is exhibited by many Twitch live-streamers. The management of these online personas is truly the definition of profile-building. O'Riordan et al. (2016) defined profile-building as the user's public identity on a specific social networking site. A live-streamer's ability to edit and craft an identity through live-stream style choices and tailoring their channel to the desired outcome relies heavily on the types of elements used during the live-stream.

Additionally, live-streamers that may not be motivated to become an entertainer but would rather pass on knowledge about a subject may choose to forego a webcam overlay. This omission returns the live-streams focus to the task being broadcast, i.e. gameplay. However, this teacher role that the live-streamer is assuming may still want to have a microphone to deliver reasoning or instructions about their current performance. Thus, the live-streamer is exhibiting *generative role-taking* with *meta-voicing* affordances by adopting a community leader role with their live-stream and adding knowledge to a reaction or opinion conversation (Majchrzak et al., 2013). Understanding what motivations for live-streaming are associated with certain affordance elements can help link the affordance preferences to the acts of live-streaming. The research that has been published currently falls just short of providing a complete linkage. However, the motivation measures that are available can be combined with the affordances that Sjöblom et al.

(2019) pointed out to help bridge a portion of this gap. For this paper, a list of affordance elements was created for the self-survey and the identified affordance was linked to it and is shown in Table 1. This link provides the ability for understanding how a live-streamer's preference for a specific affordance is observed based on how many corresponding affordance elements are in use during their live-stream. Thus, allowing this research to investigate if the streamer's known motivations have a specific relationship with the affordances. In the next section the identification of motivations and how they are measured will be elaborated on further. However, at this point it would be prudent to define the remaining affordances that were not listed above.

Table 1

Affordance elements and the corresponding affordances

The below table describes the types of affordances that can be linked to each affordance element that was identified in prior research.

Affordance	Affordance elements (location)
Profile Building	Microphone (video) Webcam overlay (video) Social media banner (video) Social media links (profile) About me (profile)
Microcelebrity	Microphone (video) Webcam overlay (video)
Generative role-taking	Microphone (video) Subscription and donate links (video) Rules section (profile) Incentive list (profile) Donation button (profile)
Meta-voicing	Microphone (video) Donation button (profile)
Social interaction and social connectivity	Webcam overlay (video) Social media banner (video) Social media links (profile)
Social revenue	Pop-up notifications (video) Top donor list (video) Subscription and donate links (video) Incentive list (profile) Donation button (profile) Top viewer list (profile)
Commercial revenue	Merchandising (video) Commercial Sponsorship (video) Video ads or Mid-rolls (video) Stagnate ads (video) Sponsorships (profile) Merchandising (profile)
Community building	Social media banner (video) Social media links (profile) Stream Schedule (profile) Rules section (profile)
Triggered attending	Social media banner (video) Social media links (profile) Stream Schedule (profile)

Two affordances that are mentioned in relative unison are *social connectivity* and *social interactivity*. Social connectivity was best described by O'Riordan et al. (2016) and they noted that it affords the linking of individuals in a system, through both commonly held information and social contacts. Basically, social connectivity describes the personal connections that take place on social networks and the available processes that can be used to complete connections. In

combination with social connectivity, *social interactivity* refers to the potential for users to communicate with social connections (O'Riordan et al., 2016). Thus, social connectivity is how the connections are made and social interactivity is how the connections are communicated with after the connection is established. For a live-streamer, the ability to connect with their viewers through visual displays, like webcams, or other social media links will influence how new connections are gained. While the communication with these new connections through lighting selection in the webcam, tweets during live-streams or highlights posted on Instagram, will influence how the connections interact with them.

Intricately linked with social connectivity and social interaction is the *community building* affordance. This affordance refers to the practice of creating closeness with connections under a unifying structure. Community building more often accompanies other affordances like generative role-taking in addition to social connectivity and social interaction. Community building in live-streaming can be seen with elements like the live-streamer's schedule, rules section and social media links. This creates consistency for viewers on how a particular live-streamer establishes their channel environment.

Another set of affordances were identified by Sjöblom et al. (2019), *social revenue* and *commercial revenue* affordances. Social revenue referred to the practices of encouraging further purchasing behavior in a community through social pressure, togetherness or even competition. This is an attempt to monetize viewers by increasing the social visibility of a recent donator or subscriber in the context of Twitch live-streamers. Commercial revenue is a more traditional means of monetization with product placements, standard advertising, paid sponsorships, etc. This behavior in the live-streaming realm is becoming more prevalent as it moves closer to mainstream society and traditional advertisers move into the industry.

The final affordance that remains is *triggered attending* and was defined by Majchrzak et al. (2013) as engaging in the online knowledge conversation by remaining uninvolved in content production or the conversation until a timely automated alert informs the individual of a change to the specific content of interest. In short, it refers to some sort of notification to individuals that were not currently involved in an event or conversation that was occurring or about to occur. A

relevant example would be a Twitch live-streamer sending a tweet to their Twitter followers informing them that their live-stream has or is about to start.

6 Measures of Motivation

As the prior section noted motivations can be drivers for affordance element selection; therefore, it is important to defined how to measure a live-streamer's motivation. This section will look to define the motivations of interest and how the measurement for that motivation was developed. A later section will discuss how each of the measures were adapted for this research.

6.1 Twitch Intensity

This measure was pulled from prior studies and was used to determine the level of emotional connectedness a user exhibited towards certain activities (Ellison, Steinfield, & Lampe, 2007; Hilvert-Bruce et al., 2018). Twitch intensity seeks to understand the level of engagement the live-streamer has for Twitch, beyond the time spent live-streaming on the platform. It is derived from the Facebook Intensity scale which sought to expand upon the time parameters and determined the parameter to be significant in explaining a portion of Facebook involvement of the studied users (Ellison et al., 2007). Since prior studies were able to identify intensity as a significant model parameter, it is worth investigating whether Twitch intensity has a relationship with the goals or affordances of the live-streamer. Furthermore, there currently does not exist research about live-streamers' motivations with an intensity measure and this research seeks to develop it.

6.2 Entertainer and Teacher

Several studies have identified entertainment and information seeking as significant motivations for viewing live-streams and joining social network sites (Chang & Zhu, 2011; Chen & Lin, 2018; Hilvert-Bruce et al., 2018; Sjöblom & Hamari, 2017). When looking to define entertainment for live-streaming, it is best to point to the definition provided by (Louis Bosshart & Ilaria Macconi) (1998) where it is described as a reception phenomenon; meaning that

entertainment is psychological relaxation offering fun stimulating change and diversion in an enjoyable atmosphere for those experiencing it (Louis Bosshart & Ilaria Macconi, 1998).

Information seeking can be described as the process of obtaining information to fill an information gap about a problem, activity, or inquiry. Another way to view information seeking was best noted by Sjöblom and Hamari (2017), who took the approach that information seeking is a niche form of entertainment; but as previously noted information seeking has been found to have a significant motivation on the watching intent of live-stream viewers. Therefore, determining the level of applicability to live-streamers that these motivations have on these individuals is the next logical step. However, live-streamers are typically the center of the attention for Twitch. For this reason, it would be of greater interest to understand if the live-streamer carries the desire to be entertaining or information providing for their viewers as a motivation for conducting a live-stream. Thus, taking on an entertainer or teacher role for their channel community and becoming the provider of the entertainment experience.

6.3 Social Organizer and Social Interaction

The social aspects of Twitch have been noted as being significant motivations to the viewers. Hamilton, Garretson, and Kerne (2014) discovered that live-streams took on the characteristics of "third places" with a community that grew and bonded through the chat box with the live-streamer and other viewers. Hamilton, et al. (2014) also mentioned how the chat box helps connect new people on a live-stream as they can share comments openly during a live-stream and be engaged in the whole experience. This engagement was identified in Sjöblom and Hamari (2017) as a positive correlation with live-stream watch time, live-stream following, and subscription habits. Later, Hilvert-Bruce et al. (2018) were able to confirm these findings and added that social interactions helped explain donations as well. These correlations were moderate but point out the importance of social interaction on a viewer's willingness to reward a live-streamer for the experience. This even helps confirm the findings of Chen and Lin (2018) which linked social interaction to attitude and perceived value, thus altering viewing intent of the audience.

6.4 Social Seeking

Social seeking has been studied in relation to online communities since the inception of the internet. John A Bargh and Katelyn Y A McKenna (2004) noted that individuals in with a lack of support from family and friends can be helped by external support, like online communities, to improve psychological well-being among the participants. Staying socially connected online was shown to reduce loneliness in a study of adolescents by Patti M. Valkenburg and Jochen Peter (2009) due to the positive relationship between self-disclosure and online communication. The ability of live-streaming to provide a relatively safe arena to discuss opinions and explore experiences simultaneously makes it a unique environment for the internet. This new societal tool can allow anxiety ridden individuals to feel comfortable participating at their own pace and even become a broadcaster for their own.

7 Data and Methodology

7.1 Survey Design

The survey consisted of 42 questions. Questions ranged from 5-point Likert scale, short answer and standard bubble selection. There were 14 sections that seek to collect information on demographics, target group criteria, motivation measures and affordance elements. The survey took on average 10 minutes to complete, was self-reported and was created using a Google Form.

7.2 Variable Measures for Survey

7.2.1 Twitch Intensity

The Twitch intensity questions were repurposed from the emotional connectedness section of Social Motivations of live-streaming (Hilvert-Bruce et al., 2018) which exchanged "Facebook" with "Twitch" in the original questions from the Facebook Intensity Scale (Ellison et al., 2007). Where it was necessary, the questions were adapted to include the relevant elements for a live-streamer to make sure the survey measurements captured the Twitch live-streamer's intensity as opposed to the viewer perspective in the previous study and were scored on a five-point Likert scale (ranging from 1 = strongly disagree and 5 = strongly agree).

7.2.2 Entertainer and Teacher

The entertainer and teacher measures were pulled from Hilvert-Bruce et al. (2018) and adjusted to analyze the live-streamer's perspective as the man focus of the viewers. These questions were originally adapted from Chang & Zhu (2011) by Hilvert-Bruce et al. (2018) where one question was removed due to a low Cronbach's alpha. For purposes of consistency the question was kept out of this research and the remaining questions were scored on a five-point Likert scale (ranging from 1 = strongly disagree and 5 = strongly agree). As an example of how the survey questions were refocused, see Table 2.

Table 2

Example of question change for entertainer and teacher motivation questions

The below changes were applied to each of the entertainer and teacher motivation questions to ensure that the question captured the intended perspective for the respondents to provide the most accurate response.

Previous Question Structure	Current Question Structure
I use Twitch to learn about unknown things.	I live-stream on Twitch to teach my viewers new things.

7.2.3 Social Organizer

The social organizer was taken from the meeting new people section of the Hilvert-Bruce et al. (2018) survey by adding the phrase "I live-stream on" to each of the questions. The original measure was taken from the three item friend seeking motivation section of the study by Chang and Zhu (2011). The scale was scored on a five-point Likert scale (ranging from 1 = strongly disagree and 5 = strongly agree).

7.2.4 Social Seeking

This measure was taken from the four items on the Hilvert-Bruce et al. (2018) survey and adjust to add "I live-stream on Twitch" in order to capture the designated perspective of this current study. The four original social seeking measures were taken from a study looking at the cultural differences in motivations for social network sites (Yoojung Kim, Dongyoung Sohn, & Sejung Marina Choi, 2011). The questions were changed by Hilvert-Bruce et al. (2018) through the replacement of "social networking sites" with "Twitch". The scale was scored on a five-point Likert scale (ranging from 1 = strongly disagree and 5 = strongly agree).

7.2.5 Social Interaction

The measure was adapted from the four items about social interaction in Hilvert-Bruce et al. (2018), which was originally repurposed from Chiu, Hsu, and Wang (2006) by replacing "virtual communities" with "Twitch" for their study. Where suitable the question was adjusted by adding a form of "I live-stream on Twitch…" to target the desired viewpoint. The scale was scored on a five-point Likert scale (ranging from 1 = strongly disagree and 5 = strongly agree).

7.2.6 Professional Focus

This measure was created using a certain number of factors. One looked at the self-perception of the live-streaming activity using a 5-point Likert scale (ranging from 1 = strongly disagree and 5 = strongly agree) to determine how much the live-streamer agrees with the statement, "Live-streaming is strictly a profession to me and not a hobby." The purpose is to understand how the live-streamer thinks about their activity of live-streaming on a subjective level then follow up with other objective measures. The objective measures look for partner status on Twitch (Partner, Affiliate, neither), how many followers, subscribers and donations (in dollars) the live-streamer has at the time of the survey.

7.2.7 Time spent

Time spent was asked to determine if the live-streamer can qualify as a survey participant, needing to have live-streamed at least once in the past thirty days. Additionally, the frequency of the live-streaming on an average basis and the past week were asked. One item, "On average, how many hours do you spend watching on Twitch per week?", was adapted from Hilvert-Bruce (2018), replacing "watching" with "live-streaming" for the purpose of this study.

7.2.8 Affordance elements and mapping to the affordances

A list of significant affordance elements from, The ingredients of Twitch (Sjöblom et al., 2019), was added to determine which affordances apply to these live-streamers. This list asks for the live-streamer to select all the affordance elements that the live-streamer uses during the average live-stream. Later these affordance elements are mapped back to the affordances based on the identified link from Sjöblom et al. (2019).

7.3 Data Collection

The sample consisted of 141 survey respondents with the demographic breakdown shown in Table 3, see Table A.1 for motives and affordances tables. The self-report online survey was distributed on Reddit[i] from September 3rd, 2019 to October 6th, 2019, under a subreddit community that was dedicated for Twitch streamers. Participants had to be at least 16 years old and must have

live-streamed in the past 30 days to be included in the analysis. 17 survey responses were removed for being spam or not meeting the minimum requirements for age and streaming. Another 8 survey replies were removed due to missing values. This left 116 observations to be analyzed in this research. To help with gaining survey responses, a Steam gift card giveaway and an incentive of a Reddit Gold award[ii] was provided to respondents, see A.2 in the Appendix. Table 3 shows the respondent's demographics for the streamers.

Table 3

Demographic observations

All groupings are listed in their original structure as listed on the survey.

Demographics	Observations	
Age	16 to 25 years old:	53
	26 to 39 years old:	59
	40 to 54 years old:	4
Gender	Male:	92
	Female:	24
Highest level of education	Some high school:	5
	High school graduate:	25
	Some college:	43
	College graduate:	37
	Master's degree or over:	6
Current employment status	Full-time:	49
	Part-time:	12
	Self-employed:	14
	Student:	29
	Unemployed:	12
Housing status	Homeowner:	23
	Renting:	49
	Living with Parent:	44
Last year's income from live-streaming	Under $50:	68
	$50 - $250:	16
	$250-$500:	9
	$500-$750:	4
	$750-$1,000:	1
	$1,000-$2,500:	4
	$2,500-$5,000:	5
	Over $5,000:	2
	Prefer not to say:	7
Last year's income from all sources (live-streaming and not live-streaming)	Under $1,000:	19
	$1,000-$4,999:	11
	$5,000-$9,999:	8
	$10,000-$29,999:	26
	$30,000-$49,999:	24
	$50,000-$99,999:	11
	Over $100,000:	5
	Prefer not to say:	12
Twitch Programs	None:	34
	Twitch Affiliate:	85
	Twitch Partner:	5

7.4 Methodology

7.4.1 Multiple Correspondence Analysis (MCA)

MCA was used for the analysis of the survey responses. The method provides an effective visual interpretation of the Likert scale categorical data. MCA tries to cluster the observations, described as *objects*, across the multiple categories into groups with elements that have similar characteristics (Kinser, 2018). These groups are known as homogenous groups and MCA defines these groups by plotting the objects in a p-dimensional space. The coordinates of the objects are determined by minimizing the sum of squared distances for all the categorical variables. This allows MCA to construct a joint mapping of the objects and categorical variables with each category point being the center of gravity for the object points that belong to that category point. To clarify, the centroid is the weighted average of the homogenous group for the objects that are elements of this category point. For example, if 500 out of 10,000 respondents selected 'strongly agree' for category 1 then the coordinates for category 1 - 'strongly agree' would be centered between the 500 respondents at the point that minimizes the sum of squared distances.

The theoretical process by which MCA is solved starts as follows: For $i = 1, \dots, n$ objects, a collection of data over m categorical variables produces a set of $n \times k_j$ binary indicator matrices, G_j, where each of the $j = 1, \dots, m$ variables becomes k_j different values based on the levels associated with each m variable (Jan de Leeuw and Patrick Mair, 2007). Once created all G_j binary indicator matrices are collected into a block matrix

$$G \triangleq [G_1 \vdots G_2 \vdots \cdots \vdots G_m]. \quad (1)$$

From here the row sums of G_j are stored in a diagonal matrix M_j, with missing object values being set as zero row sums; thus, if object i did not appear at variable j then the row sum for i in G_j is 0, else the sum will be 1 due to the disjoined nature for the category entries (Jan de Leeuw and Patrick Mair, 2007). At this point, let X be the unknown $n \times p$ object coordinates matrix for the object projections into $\mathbb{R}^p$. In addition, let Y be the unknown $k_j \times p$ matrix with the coordinates for the category projections on the p-dimensional space (Jan de Leeuw and Patrick Mair, 2007). This yields the below loss function

$$\sigma(\mathrm{X};\mathrm{Y}_1,\mathrm{Y}_2,\dots,\mathrm{Y}_\mathrm{m}) \triangleq \sum_{\mathrm{j}=1}^{\mathrm{m}} \mathrm{SS}\big(\mathrm{X}-\mathrm{G}_\mathrm{j}\mathrm{Y}_\mathrm{j}\big) \triangleq \frac{1}{\mathrm{m}}\sum_{\mathrm{j}=1}^{\mathrm{m}} \mathbf{tr}\big(\mathrm{X}-\mathrm{G}_\mathrm{j}\mathrm{Y}_\mathrm{j}\big)'\mathrm{M}_\mathrm{j}\big(\mathrm{X}-\mathrm{G}_\mathrm{j}\mathrm{Y}_\mathrm{j}\big). \quad (2)$$

Having the loss function the process of minimizing the equation was performed using the *homals* package in R which was created by Jan de Leeuw and Patrick Mair (2007). This package uses the *alternating least squares algorithm* for minimizing the loss function. The iteration process starts at $t = 0$ with random object coordinates, $X^{(t)}$. Then the algorithm proceeds as follows:

1. Update the category coordinates, Y: $Y_j^{(t)} = D_j^{-1} G_j' X^{(t)}$ (3)
2. Update the object coordinates: $\tilde{X}^{(t)} = M_*^{-1} \sum_{j=1}^{m} G_j Y_j^{(t)}$ (4)
3. Normalization: $X_{(t+1)} = \mathbf{orth}\big(\tilde{X}^{(t)}\big)$ (5)

where $D_j \triangleq G_j' M_j G_j$, $M_* = \sum_{j=1}^{m} M_j$ and **orth** computes the orthonormal basis for the column space of the matrix (Jan de Leeuw and Patrick Mair, 2007).

Once minimization of the sum of squared distances has been achieved then both the objects and categories are plotted for visual interpretation. The biplot is the plot that includes all the objects and the centroids in a two-dimensional Euclidean space. This allows for the viewer to determine the object density around each centroid in the plotting area. The joint plot removes the objects from the plotting field and focuses on the centroid points. It can be used to determine which categories arrange themselves towards one another. As stated earlier, the category points represent the center of gravity for the objects that chose the corresponding category points; thus, centroids being clumped together will show that objects in that specific category level are similar. Something to note is the number of dimensions available in an MCA. The total number of dimensions for every MCA is equal to the number of levels across all categories less the number of categories. Therefore, data with 10 categories having four levels, will have thirty dimensions. Given this fact, as the number of dimensions increases, the difficulty of choosing dimensions to analyze becomes increasingly more difficult. To help with this process, a quick review of the eigenvalues is suggested. The eigenvalues are a good indicator of where to start the analysis because the eigenvalue associated with each dimension is essentially a ranking of which dimension is the most important for explaining the data. The dimension with the largest eigenvalue is the most important

dimension for explaining the data, relative to the other dimensions and should be reviewed first to determine if useful information can be gathered. After selecting which dimensions to review, it is equally as important to understand how to interpret the meaning of each dimension.

Within each dimension there exists several discriminant values. Each value represents the spread of the variable's category points, meaning the larger the discriminant value the further apart the category points (Hoffman & Leeuw, 1992). Applying this knowledge to the current study as an example, the larger values will allow us to easily see the differences present within the category across each of the Twitch live-streamers. As Hoffman and Leeuw (1992) noted, the discrimination measures are quantified as the squared correlations of X, the Twitch live-streamers, and the optimally transformed variables, $G_j Y_j$, and should be interpreted as the squared factor loadings. Thus, as mentioned above MCA assigns coordinates to each variable that maximizes the spread within each dimension.

7.4.2 Bootstrap

Given that this research could only afford to do one small sample; there is no reasonable way to obtain population data; and additional sampling efforts were not possible under the current time constraints, the eigenvalues were checked for stability using the bootstrap resampling method. This method was selected due to its convenience and theoretical accuracy to create several samples and a pseudo distribution for the calculated eigenvalues. This process is important to perform because it helps determine where the estimate may fall in the population. If the calculated estimates are determined to be outliers after the resampling process, then the original sample would not be reflective of the population and any interpretations made in this research should be applied with extreme caution. Conversely, if the eigenvalues do fall within a confidence interval then the conclusions made in this research can be considered applicable to the population.

Bootstrapping is performed when population data is not available for comparison to the original sample data. In this case, the bootstrap resampling method is used to create a pseudo-population of the data, more commonly referred to as the bootstrap population. This bootstrap population is created by randomly sampling the original sample n times with replacement, where n is the number of observations in the original sample. Since the sampling is done with

replacement, meaning that the same observation can be included in the bootstrap sample multiple times, each observation is equally likely to be selected at each sampling opportunity (Bradley Efron & Robert J. Tibshirani, 1993). For this reason, each sample is independent from all prior bootstrap samples. Once, n observations have been collected then the new bootstrap estimate can be calculated, called $\hat{\alpha}^{*1}$. However, to determine the level of stability for the original estimate the procedure is repeated B times, where B is generally 1000 cycles or more. This allows the bootstrap process to create multiple distinct data sets, thus formulating the pseudo-population (Bradley Efron & Robert J. Tibshirani, 1993).

By means of the distribution that is created from this bootstrap population the parameter can be compared and the standard deviation calculated. The process begins with the bootstrap matrices, denoted by $\mathrm{Z}^{*\mathrm{b}}$, where $b = 1,2,\dots,B$ repetition. The parameter $\hat{\alpha}^{*\mathrm{b}}$ is computed for every $\mathrm{Z}^{*\mathrm{b}}$and the standard error of the parameter is:

$$SE_B(\hat{\alpha}) = \sqrt{\frac{1}{B-1}\sum_{r=1}^{B}\left(\hat{\alpha}^{*b} - \frac{1}{B}\sum_{r'=1}^{B}\hat{\alpha}^{*r'}\right)^2}, \tag{6}$$

remembering that B is the total number of repetitions for bootstrap population (Bradley Efron & Robert J. Tibshirani, 1993).

7.5 Data Preparation for the MCA

7.5.1 Creation of the affordance measure

As previously noted in Table 1, prior research has determined which affordance elements correspond to the appropriate affordance. Given that this paper wants to understand any potential relationships between affordances and motivations an additional step was warranted for the affordance measure. Referring to the concept of affordance theory that was discussed earlier, each affordance element present in a live-stream can have several affordances. To determine how a live-streamer's motivation aligned with certain affordances, the survey that was conducted asked them to select each affordance element that they consistently use during a live-stream. Given that the research from Sjöblom et al. (2019) linked the affordance elements of live-streamers to the

appropriate affordance, a preset map was provided by this research. Hence, to analyze this data a point assignment was used to map the affordance elements that were selected to their appropriate affordance associations from the prior research and the overall field of affordance theory. For clarity, if a live-streamer selected the following affordance elements a microphone, donation button in the profile, and social media links in the profile then as Table 4 shows, the allocation would be 2 points for profile building out of a possible 5 points given the elements that they have selected. The process was completed for all observations and the scores were used as a preference measure for each affordance. Essentially, classifying the live-streamer's preference or adoption of each affordance. This was done with the idea that affordance theory explains that an affordance exists in an affordance element regardless if it is perceived or not (Gaver, 1991) and even if the user doesn't perceive the affordance of a specific affordance element it is still present in the affordance element. Thus, the user prefers certain affordances based on the number of affordance elements they elect to use during a live-stream.

This may not be immediately obvious, but here is an example to illustrate the point. Take a desk that a person works at daily. There are many affordance elements on that desk like pens, a coffee cup, cell phone, computer mouse, etc. All these affordance elements have *grasping* as an inherent affordance. While their designed purpose may have other primary uses, grasping is definitively one they all share. Furthermore, the more affordance elements that share the grasping affordance on the desk the more it can be inferred that this affordance appeals to the person at the desk, given they have hands. Thus, the same logic is being used for the live-streaming affordance elements with the help of the prior affordance research on Twitch live-streamers. As the number of affordance elements increases under a specific affordance the greater the preference for that affordance by the live-streamer. This process helped simplify the survey, preventing the need for a complicated explanation of an affordance then a question about which affordance preference the live-streamer carries.

Table 4

Affordance point mapping for live-streamer example

Below shows the total number of points available for each affordance and how the example scores using the point mapping method that was derived for the analysis. The points earned column is displaying the example's score and the **bolded** affordance elements are the elements listed in the example.

Affordance	Affordance elements (location) 1-point each	Points Available	Points Earned
Profile building	**Microphone** Webcam overlay Social media banner (video) **Social media links (profile)** About me (profile)	5	2
Microcelebrity	**Microphone** Webcam overlay	2	1
Generative role-taking	**Microphone** Subscription and donate links (video) Rules section (profile) Incentive list (profile) **Donation button (profile)**	5	2
Meta-voicing	**Microphone** **Donation button (profile)**	2	2
Social interaction and connectivity	Webcam overlay Social media banner (video) **Social media links (profile)**	3	1
Social revenue	Pop-up notifications (video) Top donor list (video) Subscription and donate links (video) Incentive list (profile) **Donation button (profile)** Top viewer list (profile)	6	1
Commercial revenue	Merchandising (video) Commercial Sponsorship (video) Video ads or Mid-rolls (video) Stagnate ads (video) Sponsorships (profile) Merchandising (profile)	6	0
Community building	Social media banner (video) **Social media links (profile)** Stream Schedule (profile) Rules section (profile)	4	1
Triggered attending	Social media banner (video) **Social media links (profile)** Stream Schedule (profile)	3	1

Table 5

Category levels that were combine for MCA

The below changes were made to ensure that each bin within the category variables contained at least 5% of the survey observations. Unless specified differently the levels follow a standard 5-point Likert scale, 1 = Strongly Agree to 5 = Strongly Disagree. Levels that include 0 are from the point mapping of the affordances and not the Likert scale survey questions.

Categories	Previous levels → Current levels
Microcelebrity and Meta-voicing	0 1 2 → 1 2
Profile building	0 1 2 3 4 5 → 2 3 4 5
Generative role-taking	0 1 2 3 4 5 → 1 2 3 4 5
Social revenue	0 1 2 3 4 5 6 → 0 1 2 3 4 5
Commercial revenue	0 1 2 3 4 5 6 → 0 1
Twitch Intensity Q1-Q3, Q5 Social Organizer Q1 Social Seeking Q4 Social Interaction Q1, Q3, Q4	1 2 3 4 5 → 1 2 3 4
Twitch Intensity Q6 Entertainer on Twitch Q1-Q3 Social Organizer Q2 Social Interaction Q2	1 2 3 4 5 → 1 2 3
Teacher on Twitch Q1, Q4 Social Seeking Q1-Q3 Live-streaming profession (Prohobby)	1 2 3 4 5 → 2 3 4 5
Teacher Q2, Q3	1 2 3 4 5 → 2 3 4

7.5.2 Consolidation of motivation and affordance measures

To prepare for the MCA the data was summarized to determine if any of the feature's category bins did not have a frequency of at least 7 observations, which represents the 5% threshold of the total usable observations[iii]. Table 5 displays the category levels that were combined to form the prepared MCA data set based on the 5% threshold criteria. Additionally, the continuous variables; average hours spent live-streaming on Twitch per week; hours spent live-streaming during the past week on Twitch; and current number of followers were transformed into categorical variables with respect to their quantiles. While some information is lost by performing this operation, the gain in the visual representation on the MCA mapping was considered more valuable.

Table 6
MCA eigenvalues by dimension
The below data shows the calculated eigenvalues for first four dimensions.

Dimension	Eigenvalue
One	0.204
Two	0.133
Three	0.119
Four	0.113

8 Results

8.1 Eigenvalues and Stability

After performing the MCA, the eigenvalues were analyzed under each dimension in order to get an understanding of which dimensions should be focused on for additional analysis. In reviewing Table 6, we can see that the eigenvalues drop off significantly after dimension one and are relatively level from dimension two onward with only minimal reduction in the eigenvalue for each of the subsequent dimensions. This shows that little explanation of the variance is gained for each additional dimension that is included in the analysis. Once the eigenvalues were reviewed it was clear that dimension one dominated the other dimensions by its larger eigenvalue relative to the other dimensions. The first four dimensions are shown in the table to provide an understanding of how the remaining dimensions' eigenvalues flatten out. The eigenvalue for dimension three is only slightly higher than the eigenvalue for dimension four and it should be noted that this behavior only narrowed for the dimensions not shown. Note, that as the dimensions increase the lower the explained variance for each additional dimension. For this reason, dimensions should be selected for interpretation based on the increase in explained variance. Additionally, dimensions that include interesting category explanations may also be considered. With both these notes in mind dimension one was selected under both scenarios. Dimensions two, three and four were kept for interpretation due to some of the category variables having large discriminant values while still providing a slight jump in variance explanation. Further, as part of the review of the eigenvalues a bootstrap was performed on the eigenvalues to determine the level of stability.

The bootstrap resampling method was repeated for 1000 iterations to ensure a large enough distribution could be computed for stability. After each sampling, the MCA was performed, and

the eigenvalues were computed for that bootstrap sample. The results of the bootstrap yielded concerns about the stability of the original sample's eigenvalues. In Figure 1, it shows dimension 1 falling just inside the 97.5 and 2.5 percentiles of all the bootstrap samples. Additionally, most of the other dimension's eigenvalues are listed as outliers in the remaining boxplots.

Figure 1

Boxplot of the bootstrap eigenvalues

The results below display the computed eigenvalue for the 1,000 bootstrap iterations, the original sample's eigenvalue (red dot) and the 2.5 and 97.5 percentiles for the data (blue triangles).

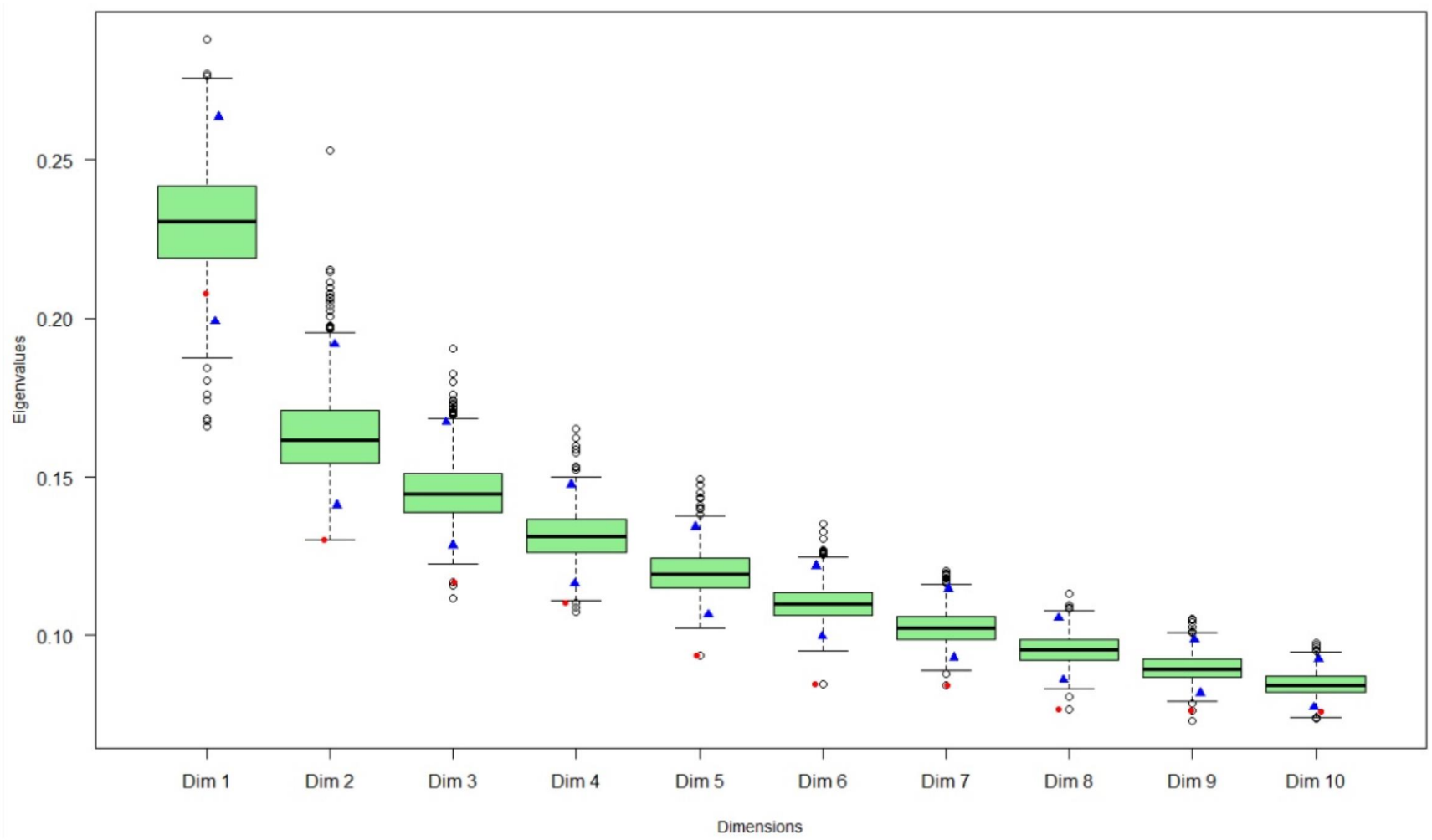

Table 7
Discriminant measures for each dimension
The data below only represents category variables with discriminant measures larger than .3 within the first four dimensions. All the category variables that did not have at least one discriminant measure greater than .3 were removed for aesthetics but the complete list can be found in the appendix A.3. Note: The larger the discriminant measures the greater the spread between the category variable's levels, making it easier to distinguish.

Category Variables	One	Two	Three	Four
twitchint q3	**0.400**	0.084	0.264	0.142
twitchint q5	**0.413**	0.153	0.086	0.163
enter q2	**0.323**	0.112	0.202	0.103
enter q3	**0.300**	0.126	0.015	0.042
seeker q2	0.035	0.012	0.104	**0.302**
seeker q3	0.033	0.011	0.076	**0.452**
social q2	**0.327**	0.063	0.003	0.145
prof bldg	0.241	**0.579**	**0.540**	0.116
gen rt	**0.451**	0.166	0.041	0.082
social all	0.250	**0.539**	**0.515**	0.107
social rev	**0.357**	0.054	0.111	0.022
com bldg	0.272	**0.450**	0.269	0.184
trig att	0.218	**0.491**	**0.362**	0.094
avghrs cat	**0.322**	0.064	0.146	0.079
follow cnt cat	**0.361**	0.028	0.085	0.016

8.2 Category Discriminant and Dimension Interpretation

After the bootstrap analysis the next step was to look at the discrimination measures of the category variables to understand how to interpret the dimensions that were just computed. When looking at the discriminant measures it is best to limit the scope of the dimension interpretation to the category variables with the largest discriminant values. For this reason, Table 7 displays only the category variables with discriminants larger than .3 in the four dimensions of interest. For the remaining category variables, the motivation questions of twitch intensity question 3 and question 5 (twitchint q3 & q5); entertainer on twitch questions 2 and 3 (enter q2 & q3); social seeker question 2 and question 3 (seeker q2 & q3); and the social interactions question 2 (social q2) appear to discriminant well in their respective dimensions. Furthermore, the affordances of profile building (prof bldg), generative role-taking (gen rt), social interactivity and connectivity (social all), social revenue (social rev), community building (com bldg.) and triggered attending (trig att) discriminant strongly across their respective dimensions. The final two remaining categories were the average hours per week spent live-streaming (avghrs cat) and current follower count range

(follow cnt cat). Since these variables have the largest discriminant measures, they were selected as the variables to be included in the visualizations of the biplot and the joint plots. These plots were used to interpret the survey data to determine if notable associations exist for the data that was collected. To be clear the category variables twitchint q3, twitchint q5, enter q2, enter q3, social q2, gen rt, prof bldg, social all, social rev, com bldg, trig att, avghrs cat, and follow cnt cat were used to interpret dimensions 1 and 2, while seeker q2 and seeker q3 helped to interpret dimension 4. It should be noted that dimension 3 is being excluded from the remaining portion of the interpretation as the category variables that best discriminate on that dimension are nearly identical to dimension 2. For this reason, dimension 3 was not interpreted further.

Looking at dimension one the best discriminating category variables were twitchint q5 and gen rt at .413 and .451, respectively. As a reminder twitchint q5 is question 5 from the twitch intensity measures[1] and asks about the respondent's preference towards community creation on their Twitch live-streaming channel. Based on their answer to this question, it can be determined if the respondent is motivated to build a strong viewer community on their channel. Interestingly, gen rt, or generative role-taking, discriminates quite well on dimension one which intuitively makes sense, given that generative role-taking is the act of an individual taking on a community managing and sustaining role (Sjöblom et al., 2019). Essentially, the two largest discriminates have a central theme for dimension one as a community development measure. Additionally, the other seven category variables that were highlighted; twitchint q3[2], social rev[3], social q2[4], enter q2[5], enter q3[6], 'avghrs cat', and 'follow cnt cat' are all measures related to interacting with the live-streamer's viewers as a community leader and entertainer that engages regularly and uses community pressure to induce desired behavior. Thus, dimension one can be interpreted as the`

[1] Twitchint q5: twitch intensity question 5, "I feel I am creating a community on my Twitch channel."

[2] Twitchint q3: twitch intensity question 3, "Twitch has become part of my daily routine."

[3] Social rev: social revenue affordance, see description in section 4.

[4] Social q2: social interactions question 2: "When I live-stream on Twitch, I spend a lot of time interacting with my viewers.

[5] Enter q2; entertainer on Twitch question 2: "When I live-stream on Twitch, my goal is to make sure my viewers have fun."

[6] Enter q3; entertainer on Twitch question 3: "When I live-stream on Twitch, I want to make my viewers laugh."

community development leader dimension. In this instance, the dimension should be able to determine if the live-streamer is a passive member in their channel development or more of an active aggressive engaging entertainer.

In dimension two there are several strong category variables that discriminant well across the dimension. Prof bldg[7] focuses on the development of the public persona that a live-streamer has created using certain affordance elements in the live-stream video and profile section. The social all[8] category variable is a combination of social connectivity and social interaction elements that will help the live-streamer connect and interact with their viewers in several ways. This affordance measure should be high if the live-streamer chooses several affordance elements that help them expand connections and communicate with their connections. Trig att[9] identifies the affordance elements that generate notifications to join the live-stream when leveraged in that manner. Trig att can be used to bring a live-streamer's connection to the live-stream upon notification on social media or at specified times with the streamer schedule. Lastly, the com bldg[10] affordance measure discriminates well and would be leveraged by a live-streamer that is trying to build a consistent group of expectations among their viewers. These four category variables show that dimension two is more for the engagement manager. Unlike dimension one the categories in dimension two measure how the live-streamer uses elements to engage with their viewer base. The use of triggered attending elements combined with social connectivity and social interaction speaks strongly towards communication efforts. The profile building elements will lend themselves to a similar experience by knowing how involved the live-streamer is in crafting their channel video and profile sections. The combination of these categories makes a strong case for interpreting the dimension as a measure of the live-streamer's ability to manage their engagement with the viewer, thus the name for the dimension, engagement manager.

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[7] Prof bldg: profile-building, see description in section 4.
[8] Social all: combined social connectivity and social interactivity, see descriptions in section 4.
[9] Trig att: triggered attending, see description in section 4.
[10] Com bldg: community building, see description in section 4.

Finally, dimension four is summed up by two questions from the social seeking question set. Seeker q2[11] and seeker q3[12] each speak to the level of need for emotional support through social means. Given both questions appear to be closely related to a therapy session, it was easy to place the same description as the name. For this reason, it would be best to described dimension four as a measure of the Twitch live-streamer's need for a therapy session.

8.3 Visualizations and Associations

Figure 2
Biplot of Community Development Leader and Engagement Manager (effective executors)
The plot displays the category centroids for the community development leader dimension (dimension one) and the engagement manager dimension (dimension two) with all the observation points plotted. The category centroids are the black triangles while the object points are the grey circles. For the completely label biplot see A.4 in the appendix.

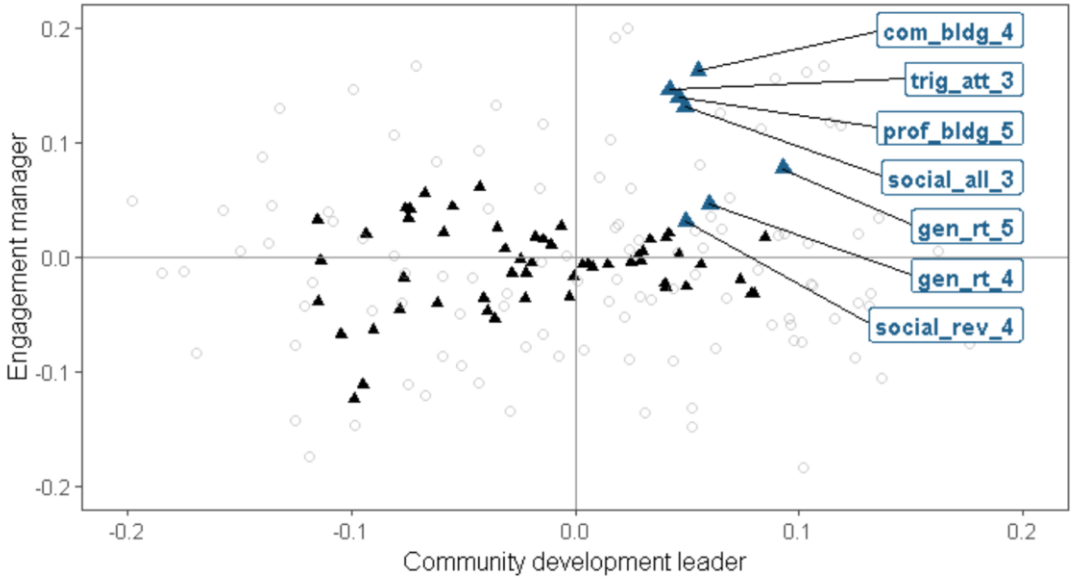
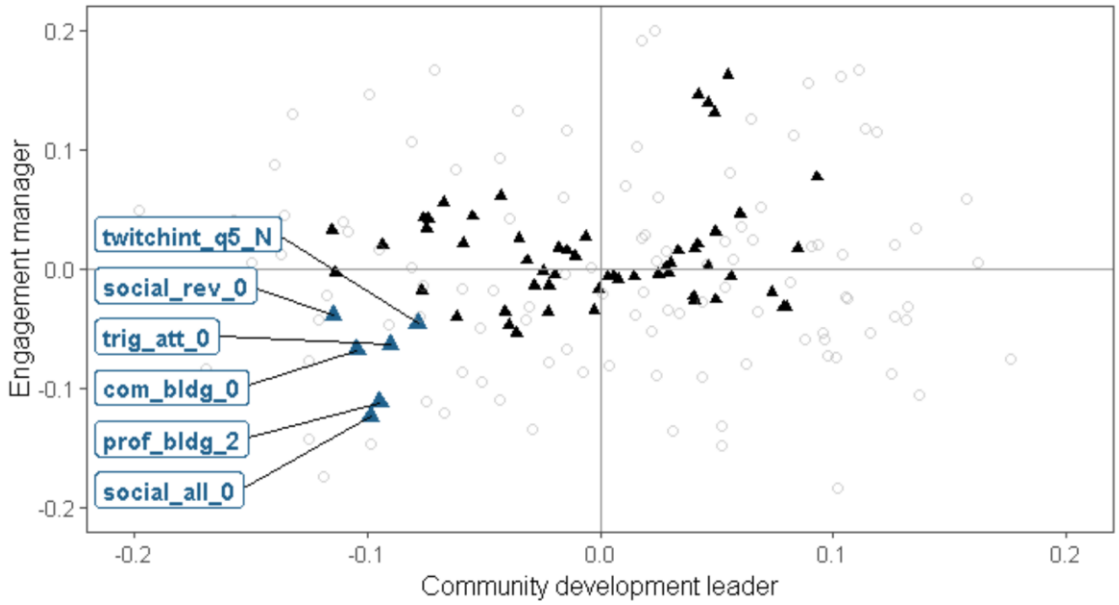


Figure 2 is the biplot of the community development leader dimension (dimension one) versus the engagement manager dimension (dimension two). In the plot the category centroids (triangles) are listed along with the observations (circles). Highlighted in blue are the first set of category centroids that can be interpreted. These centroids are relatively high along the

[11] Seeker q2: Social seeking question 2, "I live-stream on Twitch to express my anger to my viewers who will sympathize."
[12] Seeker q3: Social seeking question 3, "I live-stream on Twitch to talk out my problems and get advice."

engagement manager axis and include the following: com_bldg 4, trig_att 3, prof_bldg 5, social_all 3, gen_rt 5, gen_rt 4 and social_rev 4. The plot shows that observations near this group have high affordances scores for profile building, community building, generative role-taking and social revenue. This group is intent on creating a community and interacting with their viewers with a high degree of affordance elements. The group is most likely better at managing engagement and can leverage several affordance elements during their live-stream to achieve that engagement. For this reason, the group is described as *effective executors*, since they are leveraging many affordance elements to engage and communicate with their audience during live-streams.

Figure 3
Biplot of Community Development Leader and Engagement Manager (casual live-streamers)
The plot displays the category centroids for the community development leader dimension (dimension one) and the engagement manager dimension (dimension two) with all the observation points plotted. The category centroids are the black triangles while the object points are the grey circles. For the completely label biplot see A.4 in the appendix.



Turning the attention to other areas of the biplot reveals other interesting associations in the data. Looking at the bottom left quadrant in Figure 3 respondents have several distinct differences than the effective executors. Respondents in this quadrant were neutral on question 5 of Twitch intensity and tend to have low affordance scores across the board. The bottom left quadrant respondents would best be described as *casual live-streamers*, an individual that does not invest in a lot of affordance elements or leverage the inherent affordances of those elements when

live-streaming. This group is not focused on building a community of viewers nor do they see Twitch as a way to engage others.

Figure 4
Biplot of Community Development Leader and Engagement Manager (alignment opportunity)
The plot displays the category centroids for the community development leader dimension (dimension one) and the engagement manager dimension (dimension two) with all the observation points plotted. The category centroids are the black triangles while the object points are the grey circles. For the completely label biplot see A.4 in the appendix.

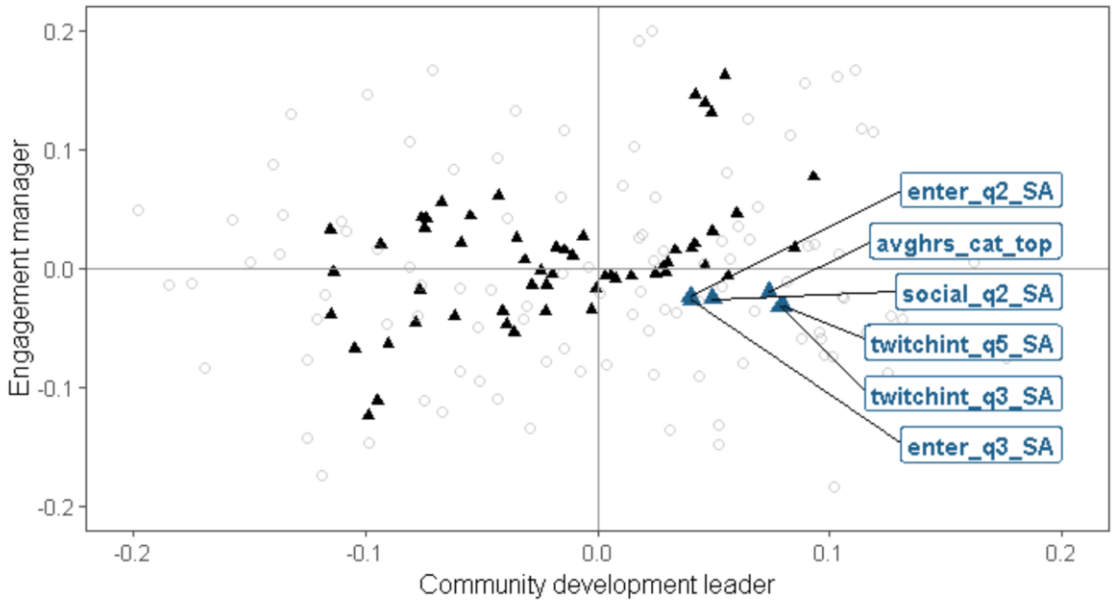
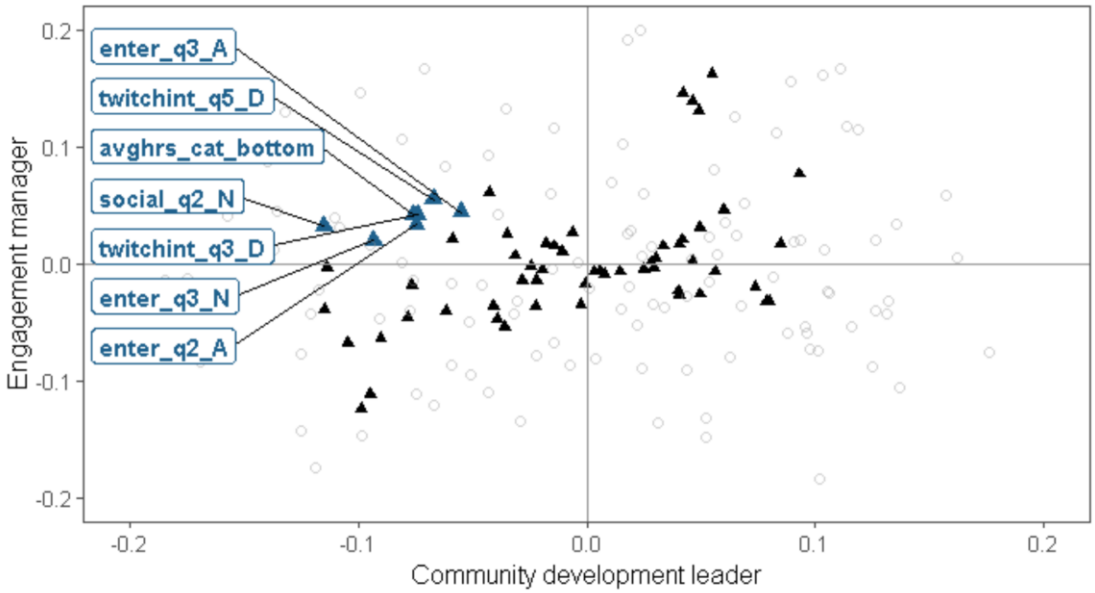


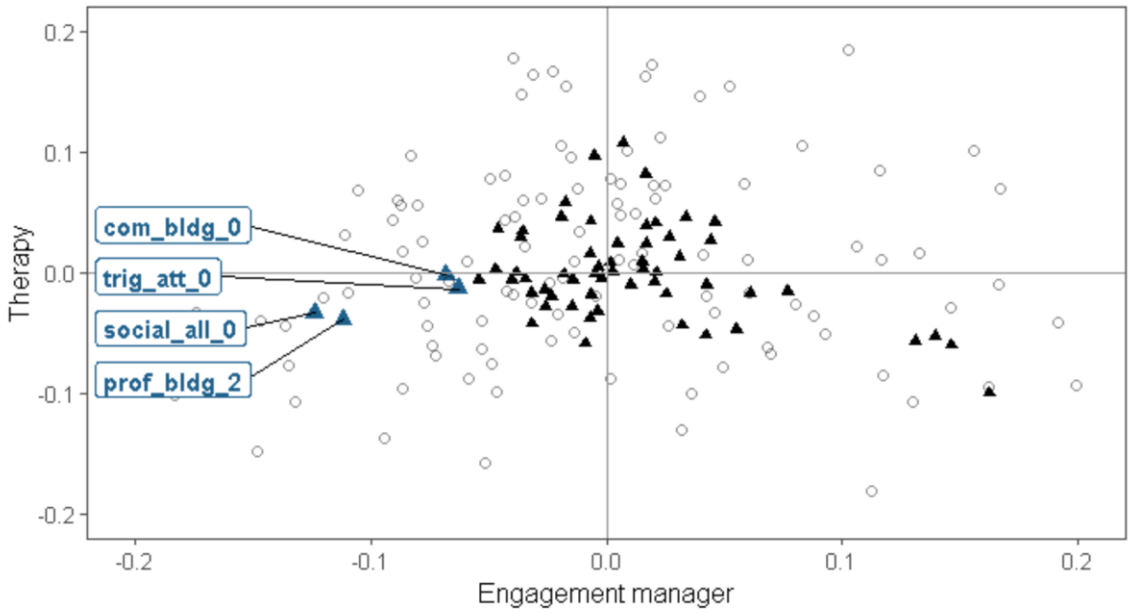
Figure 4 highlights another notable area of the biplot is the bottom right quadrant with live-streamers answering strongly agree of the social interacting question 2, entertainer on Twitch question 2 & 3, Twitch intensity questions 3 & 5 and top average hours of live-streaming of the respondents. This is intriguing because the live-streamer denotes that they make live-streaming on Twitch part of their daily routine, they want to actively interact with their viewers and believe they are building a community. However, this group does not have a consistency in affordance element selection. This could be simply related to the group not identifying their motivational goals and connecting them with the affordance elements that have affordances which best align with these goals in mind. Regardless of the reason there is a clear disconnect and there is an opportunity for these live-streamers to align. Therefore, this group is in the *alignment opportunity* area.

Figure 5
Biplot of Community Development Leader and Engagement Manager (casual fun)
The plot displays the category centroids for the community development leader dimension (dimension one) and the engagement manager dimension (dimension two) with all the observation points plotted. The category centroids are the black triangles while the object points are the grey circles. For the completely label biplot see A.4 in the appendix.



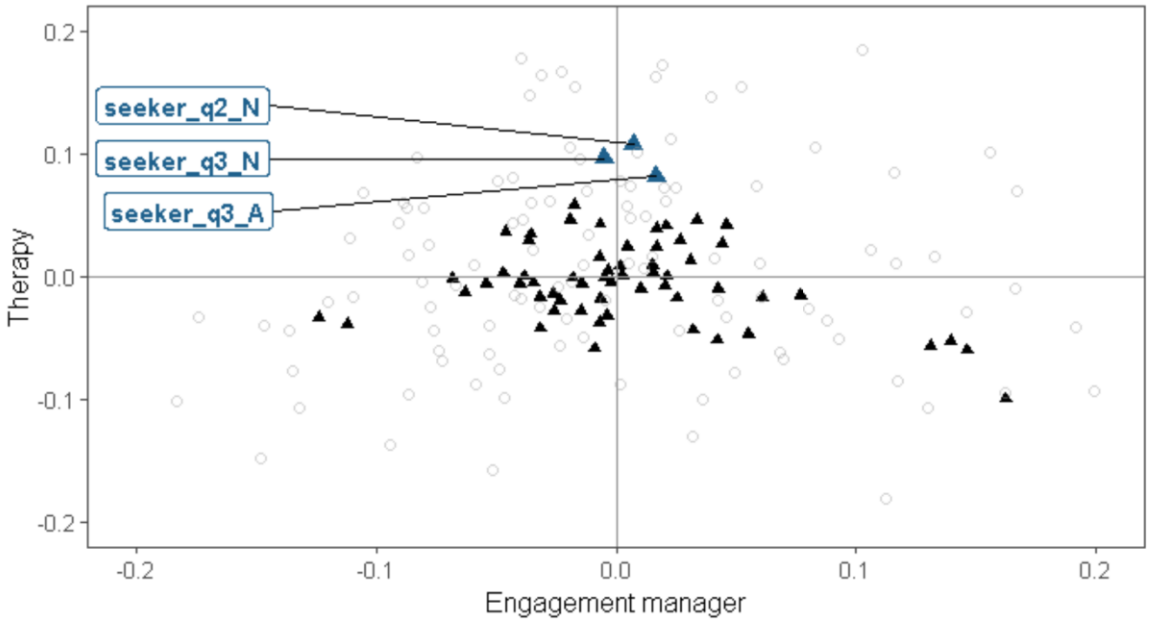
The final group for interpreting this biplot is in the top left quadrant, see Figure 5. This group agrees that they want to make their viewers laugh and have fun, but they disagree that Twitch is a part of their daily routine and are not trying to build a community. Also, this group spends the least number of hours on average live-streaming each week and tend to have fewer followers. This group appears to only be interested in having a few friends watch their stream and may intentionally continue this practice for their channel based on their motivational responses. This group is the *casual fun* area.

Figure 6
Biplot of Engagement Manager and Therapy dimensions (disinterested)
The plot displays the category centroids for the engagement manager dimension (dimension two) and the therapy dimension (dimension two) with all the observation points plotted. The category centroids are the black triangles while the object points are the grey circles. For the completely label biplot see A.5 in the appendix.



Moving to Figure 6, which is the biplot of the engagement manager dimension (dimension two) and therapy dimension (dimension four), there appear to be two areas of interest. First, in the bottom left quadrant of the biplot, the highlighted centroids note an area of live-streamers that exhibit low affordance scores. This suggests that live-streamers in this area are disinterested in interacting, connecting or creating a viewer base when they are live-streaming. This group was labeled as *disinterested* given these associations.

Figure 7
Biplot of Engagement Manager and Therapy dimensions (therapy facilitators)
The plot displays the category centroids for the engagement manager dimension (dimension two) and the therapy dimension (dimension two) with all the observation points plotted. The category centroids are the black triangles while the object points are the grey circles. For the completely label biplot see A.5 in the appendix.



The other area of interest is around the live-streamers that answered agree to social seeking question 3 and neutral to both social seeking questions 2 and 3. These live-streamers appear to use Twitch as a therapy session, venting their problems and seeking advice from others. Thus, this area seems like *therapy facilitators* where they can express anger from a small support group and create their channel experience in a similar fashion. These live-streamers could be like sports radio hosts that yell about their favorite team or personalities of a comparable nature.

9 Conclusion and Discussion

The main goal of this research was to determine what associations exist between a Twitch live-streamer's motivation to live-stream and the specific affordances used in relation to these goals while live-streaming. The link in this research was two-fold with motivation questions capturing motivational intent and the list of affordance elements capturing the affordances available. In addition, an affordance element scoring map helped assign these elements to each affordance guided by the helpful research of Sjöblom et al. (2019), which linked the corresponding affordance to each of the affordance elements during a live-stream. To simplify the analysis of these associations a multiple correspondence analysis was performed to leverage the method's visualization aspects. Using MCA of the survey responses for the motivations and affordances was useful in identifying possible latent relationships between a product's affordances and a live-streamer's motivation for live-streaming. Upon review of the MCA visualizations several live-streamer groups were noted to have different combinations of affordances and motivations that help to answer the research question. These groups were the *casual live-streamer, effective executors, alignment opportunity, casual fun, therapy facilitators* and *disinterested* groups.

Two groups that a third-party company may look to avoid pursuing are the casual live-streamer and casual fun groups. The casual live-streamer was neutral on the feeling of creating a community and typically had low scores on the affordances, meaning they did not use many affordance elements while live-streaming. Similarly, the casual fun group have the least following, only stream occasionally and are not trying to build a community which could mean they are less willing to invest in products that afford such opportunities. Both groups are most likely hobbyists who would probably not invest much money in additional live-streaming products.

The effective executors were quite different from the casual live-streamer and casual fun groups. When they live-stream they feel that they are creating a community and want to spend a significant amount of time interacting with their viewers. The affordances that are leveraged speak to these motivations with high scores in social revenue and profile building. This live-streamer group would be interested in ways of building a community and brand for themselves. Additionally, resources to help increase engagement with viewers during the stream would be welcomed. Products that help these streamers manage interactions while streaming and possibly generate

revenue without being over-bearing could be marketed to this streamer group. The development of live-streaming products that have design elements with community building, profile building, and social revenue affordances would be consumed heavily by this group. Designer and software developers should be keenly aware of how their products achieve those specific affordances if this is their target market.

The alignment opportunity group strongly agreed with live-streaming as a part of their daily routine and feel they are building a community. However, these live-streamers did not have much consistency among them when it came to their affordance elements. They might be new to live-streaming but clearly have made a strong commitment to it given their top average hours of live-streaming per week. Conversely, they could be live-streaming for a long-time and never gave much thought to the types of affordance elements they are using. Companies could see this as an opportunity to inform these live-streamers about what their product can do for them. This is the essence of an unperceived affordance. By creating targeted ads that demo a product, companies could show how their product is useful to this group in ways that may have alluded them in the past. Additionally, having a spokesperson in an ad that explains how they used the product to achieve their live-streaming goals could move members from this group into the effective executors' group.

Therapy facilitators were live-streamers that agreed or were neutral about expressing anger and talking out problems for advice during their live-stream. These live-streamers appear to have motivations that would be expected from a support group or ranting sessions. The limited association with the affordance measures could leave an opportunity in this group for a product to be developed that would help express emotion during a live-stream, such as mood filters or sound boards. Products that are designed to afford this type of emotional express with quickness and ease might be successful for consumers in this group.

The final group noted was the disinterested live-streamer group. These live-streamers did not engage with their viewers using many affordance elements which gave them several low scores. Thus, these live-streamers are not trying to engage with the viewer and may only be live streaming as an outlet for themselves. Alternatively, these live-streamers might not be aware of how they could leverage the current product offerings. Thus, educating these live-streamers may be a

successful marketing option. Also, the group might have other motivations that were not able to be captured in this study which could shed some light on this group's desire to live-stream.

It should be noted that this research had limitations on its ability to obtain enough diverse survey and representative sample responses. This limitation was specifically detrimental to the test statistics which was discovered during the bootstrap stability check of the eigenvalues. Thus, future research should expand the number of survey respondents well beyond this paper's numbers. Additionally, the overlap of affordance elements into several different affordances made it difficult to determine what the intent truly was for the affordance element. For this reason, adding questions related to the intended use of a live-streaming affordance element would be recommended in future research. Further research into the design of webcam overlays could also yield interesting results as the selection of these styles has been a calculated decision for some live-streamers and could be linked to their motivations to live-stream.

10 Appendix

A.1 - Motivations and Affordance descriptive statistics

	Twitch Intensity						Teacher			
Ratings	Q1	Q2	Q3	Q4	Q5	Q6	Q1	Q2	Q3	Q4
Strongly Agree	34	19	34	23	35	52	6	6	6	6
Agree	50	49	40	36	47	38	25	49	42	40
Neutral	17	33	20	23	20	21	36	35	31	31
Disagree	13	12	21	27	12	3	39	23	32	31
Strongly Disagree	2	3	1	7	2	2	10	3	5	8
Totals	**116**	**116**	**116**	**116**	**116**	**116**	**116**	**116**	**116**	**116**

	Entertainer			Organizer			Social Seeker			
Ratings	Q1	Q2	Q3	Q1	Q2	Q3	Q1	Q2	Q3	Q4
Strongly Agree	72	73	70	37	46	17	3	0	0	16
Agree	36	34	38	58	55	39	16	7	11	49
Neutral	6	7	7	13	14	24	22	16	23	30
Disagree	2	1	1	6	1	29	33	29	35	14
Strongly Disagree	0	1	0	2	0	7	42	64	47	7
Totals	**116**	**116**	**116**	**116**	**116**	**116**	**116**	**116**	**116**	**116**

	Social Interaction				Prohobby
Ratings	Q1	Q2	Q3	Q4	Q1
Strongly Agree	14	51	36	40	4
Agree	52	51	50	54	9
Neutral	32	8	18	13	18
Disagree	16	6	9	7	40
Strongly Disagree	2	0	3	2	45
Totals	**116**	**116**	**116**	**116**	**116**

	Avghrs_cat	Wkhrs_cat	Follow_cnt_cat
Bottom	26	26	29
Low-mid	32	29	26
Upper-mid	33	32	31
Top	25	29	30
Totals	**116**	**116**	**116**

A.1 (continued)

Point Map	Prof_bldg	Micro_cel	Gen_rt	Meta_vo	Social_all	Social_rev	Comm_rev	Com_bldg	Trig_att
0	0	3	1	3	11	13	93	9	12
1	5	34	16	36	33	15	16	19	34
2	10	79	32	77	53	24	1	39	54
3	39	-	35	-	19	25	4	37	16
4	45	-	25	-	-	26	2	12	-
5	17	-	7	-	-	10	-	-	-
6	-	-	-	-	-	3	-	-	-
Totals	**116**	**116**	**116**	**116**	**116**	**116**	**116**	**116**	**116**

A.2 – Survey Incentive Post

Twitch Streamers DESPERATELY needed for research

UPDATE: $50 Steam gift card(s) will be given away to randomly selected survey respondents

(*Note: If you previously submitted a survey you are automatically eligible)

I am researching the motivations of Twitch streamers and how these motivations relate to the type of live-streaming tools that are chosen to be used. If you can spare 10 - 15 minutes of your time to complete this research survey, I would appreciate it!

The information I am collecting is for a segmentation analysis that will be completed following the collection of all responses. I am asking for anyone who currently live-streams on Twitch to complete the survey **(regardless of the size of your channel)**. All the responses are confidential and the data collected will only be used for my thesis research.

The survey can be completed here: Twitch Survey

Once completed the thesis will be published here: Erasmus University Thesis Repository

If you submit a survey response please leave a comment so I can thank you!

Current responses: 123 (updated 9/17/2019 15:31 EST)

Giveaway details:

Currently 123 valid responses have been collected. If the survey reaches the following thresholds then the corresponding gift cards will be award to randomly selected individuals at the conclusion of the survey.

# of Valid Responses	Giveaway Prize	# of Winners
75	$50 Steam gift card	1 - $50 gift card winner
100	$50 Steam gift card	2 - $50 gift card winners
150	$50 Steam gift card	3 - $50 gift card winners
300	$50 Steam gift card	6 - $50 gift card winners
460 (not a typo)	$100 Steam gift card and $50 Steam gift card	1 - $100 gift card winner AND 6 - $50 gift card winners

Winners can only win one prize.

Drawings will only be done at the conclusion of the survey and the prize pool is determined based on the final number of survey responses. Prize pools are NOT cumulative. The streamer will be notified via their Twitch.tv channel.

Please note: Your account will be validated to confirm you are an actual twitch streamer. If any fraud is found you will not be eligible for a prize.

A.2 Survey post with incentives – The above is a screenshot of the post that was used in the subreddit community to distribute the survey. The incentive structure is also displayed to provide you with knowledge of the breakdown that respondents had available to them.

A.3
Discriminant measures for each dimension

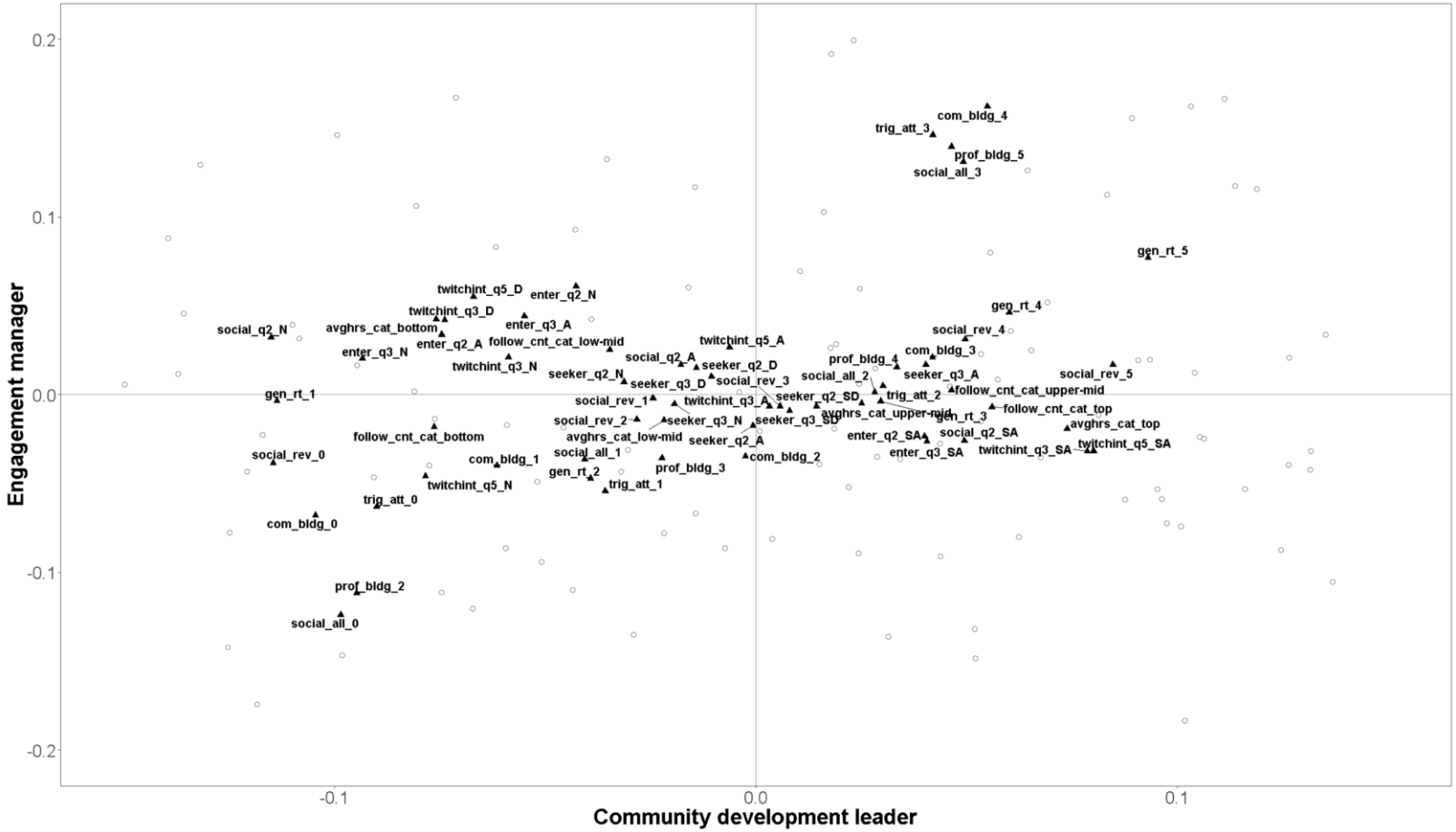
The data below is the complete discriminant measures for all category variables under each dimension that was computed during the MCA. The larger the discriminant measure the greater the spread between the category variable's levels, making it easier to distinguish.

Category Variable	One	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten
prohobby	0.199	0.124	0.025	0.084	0.03	0.112	0.094	0.084	0.038	0.097
twitchint q1	0.225	0.079	0.209	0.114	0.041	0.058	0.133	0.232	0.031	0.071
twitchint q2	0.186	0.011	0.084	0.089	0.045	0.149	0.08	0.117	0.037	0.008
twitchint q3	0.389	0.091	0.263	0.133	0.031	0.035	0.064	0.108	0.015	0.079
twitchint q4	0.211	0.05	0.037	0.076	0.183	0.18	0.079	0.037	0.103	0.046
twitchint q5	0.405	0.147	0.102	0.157	0.129	0.008	0.043	0.01	0.063	0.038
twitchint q6	0.133	0.114	0.007	0.047	0.064	0.017	0.102	0.018	0.011	0.08
teacher q1	0.105	0.04	0.035	0.135	0.064	0.109	0.057	0.036	0.006	0.106
teacher q2	0.032	0.161	0.018	0.098	0.263	0.106	0.14	0.077	0.086	0.004
teacher q3	0.003	0.126	0.082	0.077	0.11	0.053	0.032	0.03	0.061	0.029
teacher q4	0.014	0.167	0.073	0.097	0.234	0.084	0.088	0.026	0.077	0.151
enter q1	0.204	0.138	0.103	0.032	0.000	0.136	0.026	0.017	0.076	0.008
enter q2	0.286	0.116	0.226	0.107	0.008	0.076	0.003	0.074	0.073	0.009
enter q3	0.271	0.137	0.022	0.045	0.037	0.179	0.045	0.064	0.128	0.001
organize q1	0.159	0.046	0.133	0.134	0.065	0.164	0.129	0.003	0.106	0.182
organize q2	0.097	0.066	0.041	0.146	0.084	0.029	0.021	0.021	0.004	0.033
organize q3	0.12	0.062	0.101	0.104	0.166	0.057	0.073	0.077	0.051	0.032
seeker q1	0.039	0.091	0.067	0.234	0.037	0.058	0.083	0.044	0.265	0.082
seeker q2	0.033	0.017	0.1	0.303	0.078	0.052	0.084	0.047	0.329	0.086
seeker q3	0.038	0.012	0.084	0.452	0.053	0.117	0.21	0.069	0.224	0.045
seeker q4	0.099	0.035	0.159	0.098	0.186	0.059	0.109	0.049	0.179	0.111
social q1	0.238	0.106	0.097	0.116	0.105	0.033	0.142	0.07	0.126	0.06
social q2	0.321	0.068	0.006	0.134	0.131	0.009	0.05	0.091	0.042	0.000
social q3	0.197	0.138	0.052	0.102	0.215	0.095	0.056	0.236	0.05	0.116
social q4	0.226	0.132	0.049	0.127	0.18	0.017	0.057	0.258	0.067	0.06
prof bldg	0.251	0.569	0.507	0.13	0.059	0.197	0.008	0.047	0.024	0.064
micro cel	0.057	0.206	0.123	0.066	0.021	0.001	0.022	0.005	0.018	0.034
gen rt	0.46	0.159	0.039	0.083	0.084	0.088	0.081	0.086	0.061	0.157
meta vo	0.233	0.064	0.015	0.001	0.091	0.041	0.022	0.005	0	0.159
social all	0.262	0.534	0.483	0.122	0.104	0.218	0.005	0.083	0.017	0.161
social rev	0.376	0.047	0.12	0.019	0.116	0.285	0.151	0.097	0.067	0.129
comm rev	0.153	0.003	0.008	0.012	0.001	0.005	0.001	0.002	0.002	0.002
com bldg	0.27	0.463	0.228	0.201	0.211	0.111	0.384	0.119	0.243	0.055
trig att	0.223	0.505	0.312	0.111	0.090	0.092	0.474	0.118	0.021	0.072

A.4

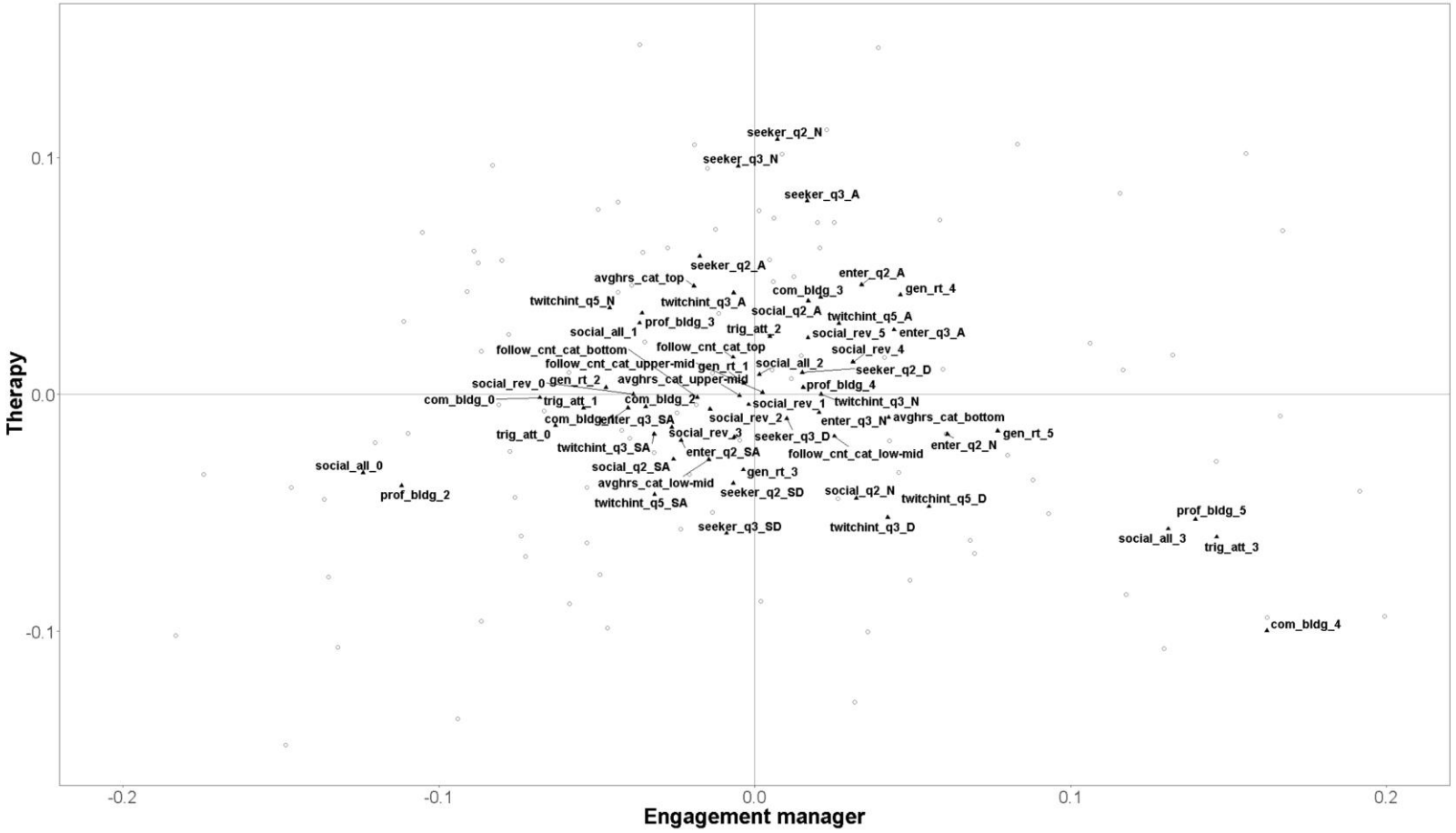
Biplot of Community Development Leader and Engagement Manager

Below is the biplot for the community development leader (dimension one) and engagement manager (dimension two) dimensions with all category points labeled. Please note that object points are shown as circles and category point as triangles.



A.5
Biplot of Engagement Manager and Therapy

Below is the biplot for the engagement manager (dimension two) and therapy (dimension four) dimensions with all category points labeled. Please note that object points are shown as circles and category point as triangles.



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[i] Reddit is the largest dedicated discussion forum website in the United States. Users can create and join communities of their interest then post and comment in the community.

[ii] Reddit Gold Award is gift that can be given to Reddit contributors (individuals that add a post or comment) which rewards the recipient with a week of Reddit Premium and 100 Reddit Coins. More information can be found at: https://www.reddit.com/coins

[iii] Usable observations were those that did not include missing values and met all criteria for being accepted as a survey respondent, i.e. being older than 16 years of age and streaming within the past 30 days. Given the criteria, 116 observations were used in the MCA analysis.